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ABSTRACT

"Investigations in Math and Science AB" is an annual science elective for students in grades 7-12 in Los Angeles Unified School District. Section 1 of this guide provides teachers with a discussion of the course content, including the course description, representative objectives, required instructional units, and enrichment activities. Basic skills to be mastered include the communication skills of speaking, listening, reading and writing; reasoning; problem solving; computation skills; and performance skills. The second section discusses lesson planning and instruction for the course and includes: (1) a list of teacher responsibilities; (2) a model for the teacher-directed lesson process; (3) an agenda format for daily activities; (4) questions and commentary for teaching decisions; (5) a suggested lesson plan format; (6) questions and vocabulary to promote higher levels of thinking; (7) steps to assist students in the problem-solving and decision-making process; (8) suggestions of ways to improve student thinking; (9) suggestions to improve students' self-image and self-worth; and (10) guidelines for assigning homework. The appendix lists resources available to district teachers. (MDH)

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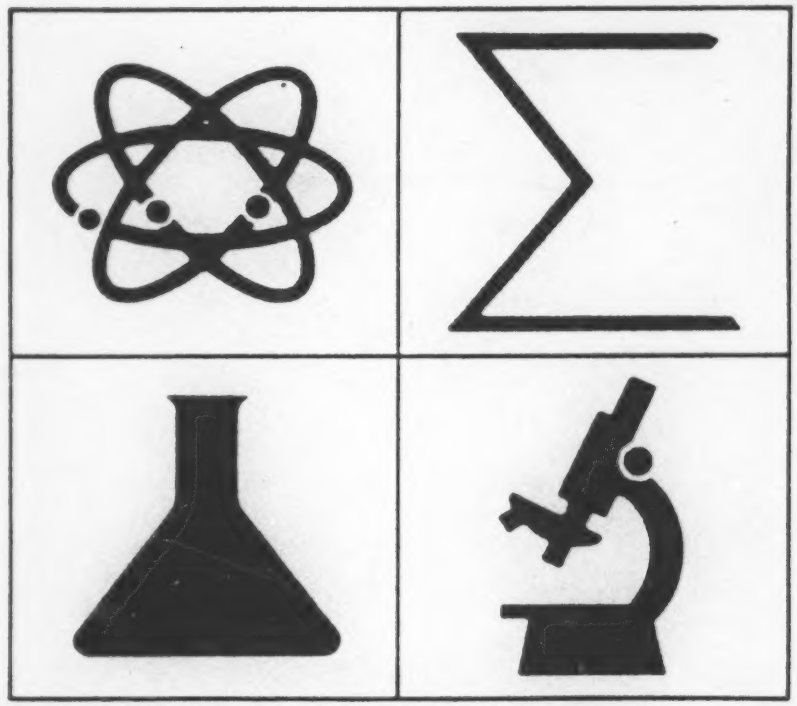
INVESTIGATIONS IN MATH AND SCIENCE AB

A Course of Study for Grades 7-12



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INVESTIGATIONS IN MATH AND SCIENCE AB

A COURSE OF STUDY
FOR
GRADES 7-12

LOS ANGELES UNIFIED SCHOOL DISTRICT
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FOREWORD

Investigations in Math and Science AB is an annual science elective course for MESA students in grades 7-12. The course provides a rigorous curriculum designed to develop knowledge and increase skills in the principles of mathematics and science and is intended to increase success in college as students prepare for careers in mathematics, science, and engineering. The course emphasizes critical thinking and problem solving and the individualization of instruction.

Teaching strategies emphasize active student participation and active learning processes. Students create and complete research-based mathematics, science, engineering, and technology projects. Activities focus on the interrelationships of science, mathematics, and technology in our contemporary society.

The course of study provides teachers with the course description, representative objectives, and required instructional units. In addition, enrichment activities and suggested resources are included. Section II contains strategies for classroom planning and higher level thinking skills and activities.

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Instruction

SECTION I

COURSE CONTENT

COURSE DESCRIPTION

INVESTIGATIONS IN MATH AND SCIENCE AB (Annual Course--Grades 7-12. No prerequisites.)

36-04-03 Inv Math Sci A
36-04-04 Inv Math Sci B

Course Description

The major emphasis of this course is to provide enhanced learning opportunities in science and mathematics and to understand related technological applications and achievements. It is designed to improve understanding of real-world problems related to mathematics and science; develop knowledge of the principles of mathematics and science; develop greater awareness of the academic preparation needed for careers in math, science, and engineering; and build skills in laboratory procedures, data collecting and analysis, and written and oral communication with math and science content. It is intended to increase success in college preparatory classes. It is recommended for students participating in programs to further academic goals in the fields of science, mathematics, or engineering. Enrollment for more than one year is permitted provided that individual student records are maintained which describe substantially different content, laboratory activities, and participation in enrichment opportunities for each year. Does not meet college entrance requirements.

Representative Objectives

In accordance with his or her present capacities, the student grows in the ability to:

- Formulate systematic approaches to decision making in the solution of complex problems.
- Compare the environmental benefits and possible side effects of technology.
- Relate modern technology to new and promising procedures in the solution of problems faced by society.
- Identify ways humankind can adapt to the rapid technological changes being experienced in modern life.
- Use laboratory equipment and materials in the investigative process.
- Make measurements using the metric system within acceptable limits of accuracy.
- Employ appropriate scientific instruments in the data-gathering process.
- Record and organize scientific data.
- Demonstrate manipulative skill in the use of a variety of laboratory materials and equipment.
- Write concise, accurate reports on the results of experiments.
- Make oral presentations on the results of experiments.

- Participate in extracurricular opportunities for enrichment, competition, recognition, and awards in science and mathematics.
- Apply appropriate mathematical concepts, processes, and skills in gathering and interpreting data, solving problems, and representing conclusions.
- Choose and use correct measurement standards.
- Convert measurements from one metric unit to another.
- Use alternate graphic forms to represent experimental data.
- Use applications in science to develop common understandings of mathematical ideas, including the role of definitions, conjectures, and arguments, and mathematical notation.
- Relate physical materials, pictures, and diagrams from science to mathematical ideas, models, and formulas.
- Describe relationships in the interaction of science, mathematics, technology, and society.
- Apply mathematics to the study of science and engineering.
- Analyze and interpret the significance of errors occurring in the gathering of scientific data when comparing the outcome of an event to its expected outcome.
- Formulate a hypothesis for a science-related problem, conduct research, collect and analyze data, make conclusions, and organize and summarize the work in a form appropriate for entry into a competition.
- Use technology such as calculators and computers for the entry, analysis, and graphical presentation of data using basic statistical procedures.
- Analyze career opportunities and requirements.

Application of Basic Skills

Provides an opportunity for students to demonstrate basic skills in areas of communication (speaking and listening, writing, and reading), reasoning, problem solving, computation, and performance skills. Examples of these skills are:

Communication

Speaking and Listening

- Gather information from the instructor and from audiovisual media by watching and listening.
- Participate in group discussions.
- Gather information from the community for classroom presentation and discussion.
- Clarify and share thinking about the relationships of mathematical ideas to situations in science.
- Relate everyday language to mathematical language and symbols as used in science.

Writing

- Write a scientific paper using the scientific method as applied to a project conducted by the student.
- Draw inferences from content.
- Apply data from reading to practical problems.

- State and substantiate hypotheses and generalizations.
- Describe the relationship of data displayed by a figure, model, graph, or chart.
- Represent the relationship of data in a figure, model, graph, or chart.
- Model and describe situations in science through concrete, pictorial, graphical, and algebraic methods.
- Use scientific notation appropriately.

Reading

- Identify main ideas.
- Define relevant and technical vocabulary.
- Read symbols, abbreviations, and formulas.
- Interpret graphs and tables.
- Follow directions in laboratory investigations.
- Organize ideas from reading.
- Utilize sources to locate materials.

Reasoning

- Use patterns and relationships to analyze and represent mathematical situations in science.
- Recognize and apply inductive and deductive reasoning.
- Investigate and formulate problems from science and mathematical situations.

Problem Solving

- Pursue solutions to open-ended problems and extended problem-solving projects.
- Generalize and use acquired solutions and strategies to new problem situations in science.
- Apply integrated mathematical problem-solving strategies to solve problems from science.

Computation

- Use the cognitive process to solve problems.
- Use mental math, pencil and paper, calculator, or computer appropriately to calculate solutions to problems.
- Develop and reinforce mathematical skills by using problems from science.
- Calculate the probability of an event to predict expected results.
- Calculate the values of mean, median, mode, and standard deviation for collected data.
- Use mathematical formulas to calculate solutions to problems from science.
- Use alternate computational methods to verify results in problems from science.

Performance Skills

The student will be able to:

- Gather needed information which has been generated by others from a variety of sources appropriate to his or her ability level.
- Use the library to find necessary information to complete projects.
- Record observations accurately.
- Organize data and ideas in ways that improve their usefulness.
- Communicate with others in a manner that is consistent with knowledge.
- Apply appropriate mathematical concepts and skills in gathering, analyzing, interpreting, and representing data.
- Apply appropriate mathematical concepts and skills in finding solutions to problems from science.

INSTRUCTIONAL UNITS

The sequence and duration of units can vary according to student needs and the instructional materials available.

I. The Interrelationships of Science, Mathematics, Technology, and Contemporary Society

II. Standards of Measurement

III. The Use of Scientific Experiments to Collect, Analyze, and Interpret Data

IV. Applying Mathematical Processes and Calculations to Scientific Experiments

V. Computer Applications in Science

VI. Understanding Units and Calculations Used in Biology, Chemistry, and Physics

VII. Weather Data and Its Usage

VIII. The Collection and Analysis of Data from Field Studies in Biology

IX. Graphing Representations, Techniques and Interpretations

X. Writing and Presenting Effective Laboratory and Scientific Research Reports

XI. Application of Science and Mathematics Skills to the Development and Completion of Science Projects

ENRICHMENT ACTIVITIES

Enrichment activities include but are not necessarily limited to:

I. Creating and completing research-based mathematics, science, engineering, and technology projects for contests and fairs.

II. Preparing for mathematics, science, engineering, and technology competitions by developing skills in performance of tasks such as:

- Identifying anatomical structures in animals.
- Making appropriate selection and assembly of laboratory apparatus to perform a specific procedure.
- Analyzing an electric circuit.
- Writing a computer program to solve a specific problem.
- Solving genetics problems.
- Using a compass to find one's way through a course.
- Using various devices to make a variety of linear, area, volume, weight, mass, and electrical measurement to acceptable accuracy.
- Expressing significant figures in measurement.
- Estimating in metric units.
- Using the Periodic Table of the Elements.
- Completing laboratory activities involving areas of physics.
- Identifying chemicals on the basis of their reactions with one another.
- Identifying various rock, mineral, and fossil specimens and answering questions about their uses and properties.
- Designing a mechanical device to perform a specific function.
- Building musical instruments, playing music, and describing the principles of sound.
- Building a nonelectronic time-measuring device that will accurately measure time to the nearest second and answering questions using the device.
- Interpreting and answering questions using a topographic map.
- Using a taxonomic key to identify various species.
- Building and calibrating a device to measure the salinity of water and using it to explain about freshwater and saltwater ecology.
- Measuring the tensile strength of spun silk threads of Bombyx mori (silklarvae) cocoons.
- Graphing data from height of jumping bimetalic disks.
- Calculating the speed and apogee of toy rockets built by students.
- Racing Helix aspera, the garden gastropod (snail).
- Determining the suitability of materials for engineering applications by measurements such as density.
- Studying polymers such as forming nutty putty (sodium silicate and alcohol).
- Studying the elasticity of materials using commonplace items such as electrician's plastic tape.
- Calculating the wave length of light rays with a shoe box spectroscope.

. Measuring the density of tap water.
. Constructing origami holiday models which require following and drawing sequential directions; using and interpreting international symbols.
. Writing instructions which will permit another person to construct a complex object properly.

III. Preparing for mathematics, science, engineering, and technology competitions with projects such as:

. Building model bridges and oil derricks
. Demonstrating skill in computer programming
. Writing essays on science topics
. Designing and testing paper airplanes
. Creating posters for art competitions with science-based themes
. Designing containers to prevent breakage in dropping an egg from a specified height

IV. Preparing for competitions which use tests and performance in mathematics, science, and engineering

V. Developing group-study techniques

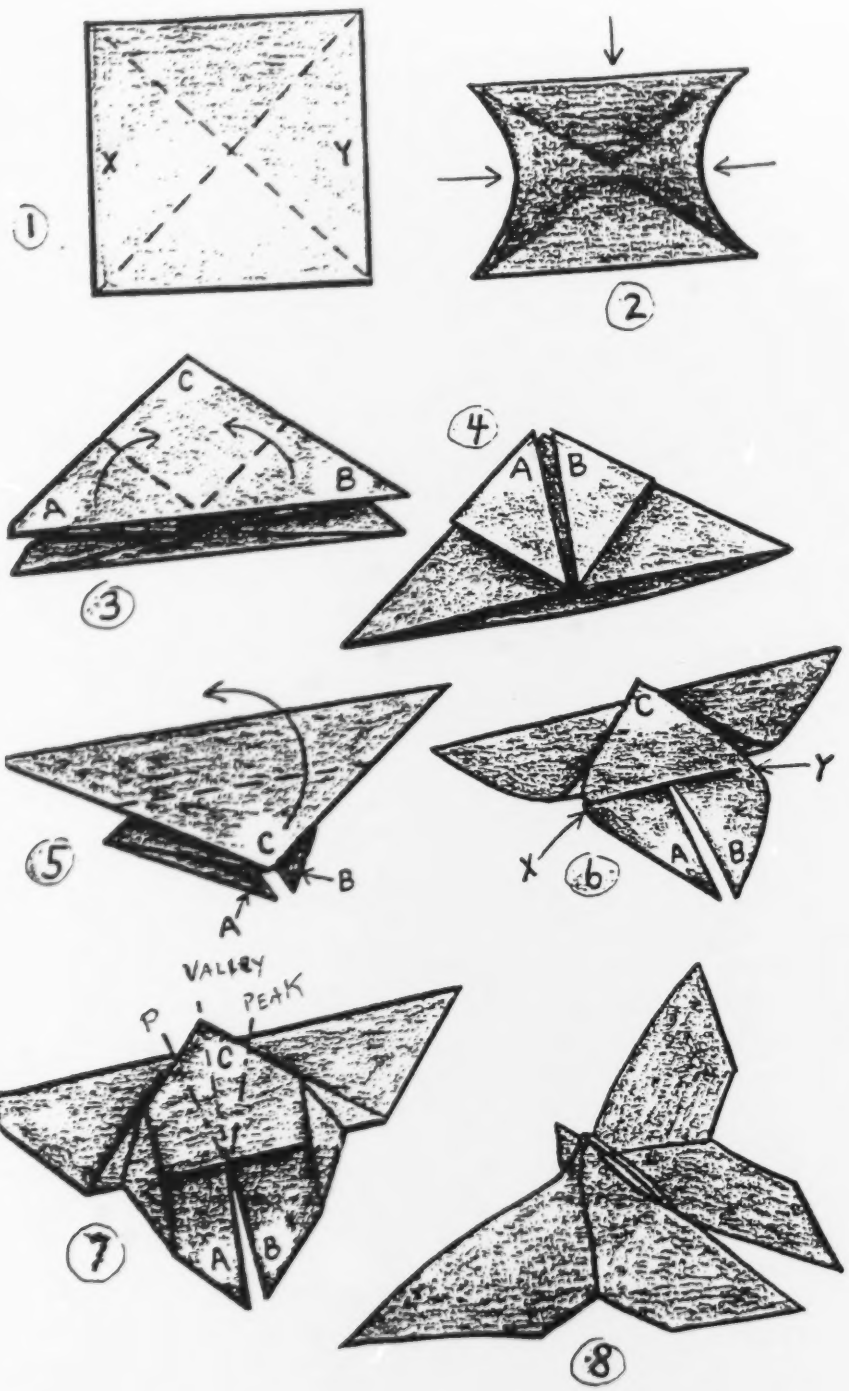
VI. Developing skills for college-entrance tests

VII. Emphasizing career guidance with exposure to a variety of mathematics and science-based choices

VIII. Providing exposure to the uses of science, mathematics, and engineering in the workplace through field trips to universities, museums, manufacturing plants, laboratories, and other sites using applications of modern technology

IX. Developing related community-service and leadership activities

BUTTERFLY



Fold your paper on the dotted lines and reopen.(1) Lift edges X and Y and push them inward as you push down on the top edge until it meets the bottom edge.(2)

Now fold corners A and B up along the dotted lines until they meet corner C.(3)

Your paper should look like this.(4)

Now turn your paper over and turn points A, B, C toward you. (5)

Now fold point C up along the dotted line until it is slightly over the upper edge.(6)

Push inward at points X and Y and push all corners down flat.(7)

Then push downward on point C along dotted line and upward on the two dash-dot lines until they come together.(7)

Turn butterfly over and curve wings slightly.(8)

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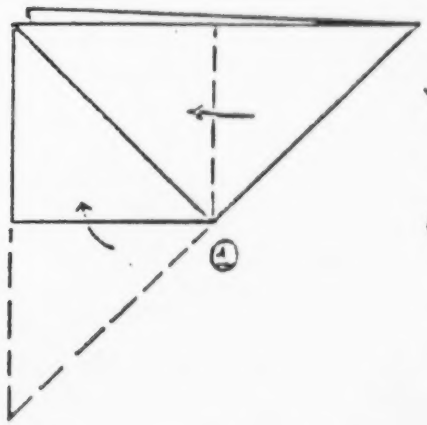
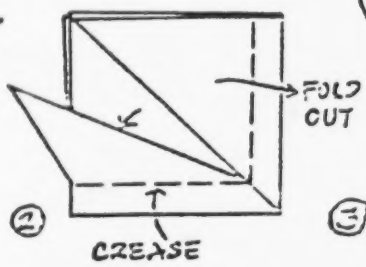
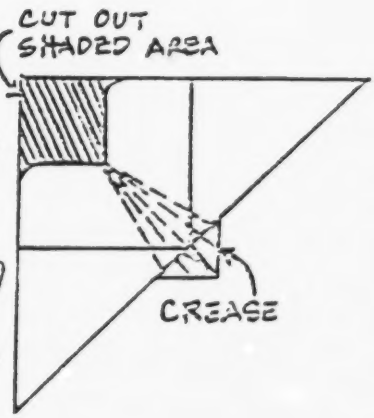
ORIGAMI FUN

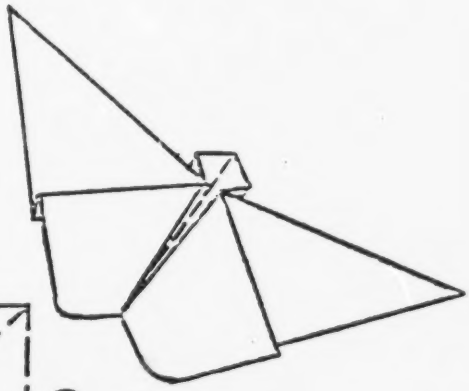




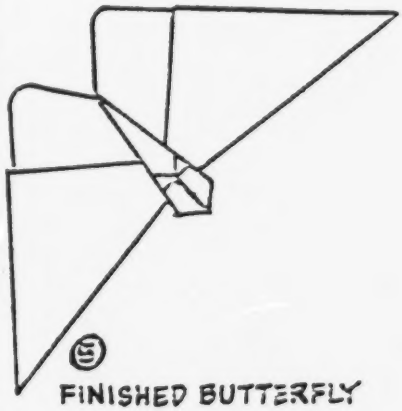


BUTTERFLY

WITH YOUR CRAYONS FILL IN THE SQUARE IN A SUITABLE COLOUR THEN CUT THE PIECE OUT AND USE IT TO MAKE YOUR BUTTERFLY.



④ UNDER SIDE



⑤ FINISHED BUTTERFLY

SECTION II

LESSON PLANNING

TEACHER RESPONSIBILITIES

The teacher is responsible for creating, maintaining, and fostering a classroom environment and a climate for learning which encourage instructional excellence and achievement. In order to maintain such an environment successfully, the teacher is responsible for:

1. Providing students and parents with a clear statement of instructional objectives, overall goals, and standards of expected progress and achievement.

2. Providing instruction which incorporates a diagnostic-prescriptive program for learning all required skills and concepts.

3. Preparing instructional activities for the entire class period, and assisting students in striving for mastery of content and process skills.

4. Having evidence in the classroom of lesson planning to meet the educational needs of the students and the goals of the instructional program.

5. Providing regular instruction and practice in preparing students to take and succeed on tests and other measures of achievement.

6. Maintaining well-defined and consistent classroom standards for academic achievement, citizenship, and work habits.

7. Providing regularly assigned homework designed to reinforce classroom instruction.

8. Providing students and parents with an explanation of the standards used for assigning marks.

9. Providing prompt feedback to students on the results of quizzes, homework, and other class assignments.

10. Recognizing individual student progress and exceptional achievements; displaying student accomplishments and products in the classroom.

11. Recording a minimum of one grade per week in the rollbook for each student

12. Keeping parents regularly informed of the educational progress and achievement of the student.

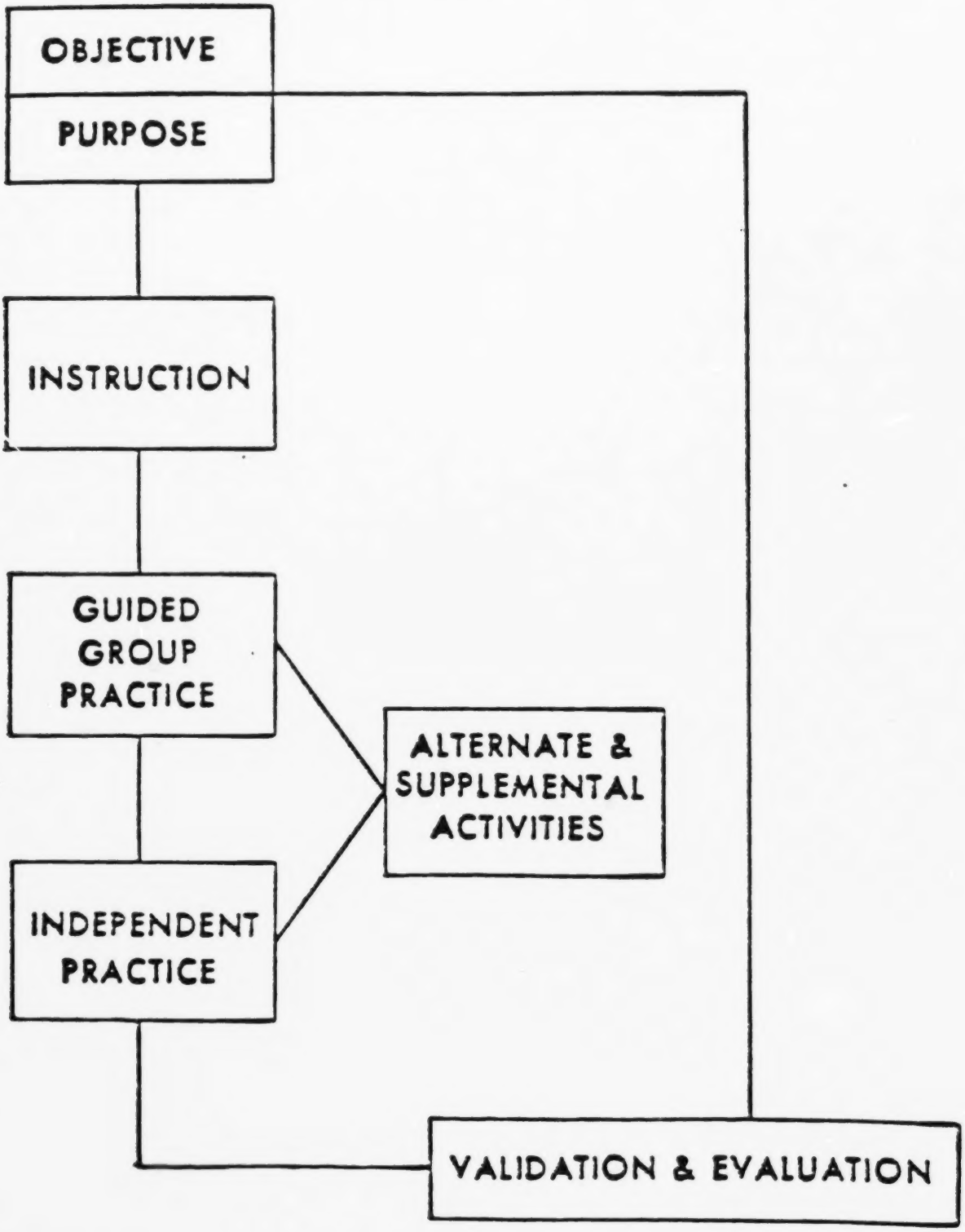
13. Informing parents of outstanding progress and accomplishment.

14. Notifying parents of any signs of significant academic decline in student effort or achievement.

15. Providing parents with suggestions on how to help the student study and complete homework assignments.

16. Inviting administrators, department chairpersons, and fellow teachers to visit the classroom and participate in a sharing of effective and innovative lessons.

TEACHER-DIRECTED LESSON PROCESS



THE AGENDA

An agenda, or schedule of class activities, prominently displayed in the classroom gives immediate directions to the students and prepares them for the day's classwork. The agenda should include an objective, a dispatch activity, scheduled class activities, and a homework assignment. The agenda may be written on the chalkboard. Some teachers, particularly teachers who travel from classroom to classroom, prefer to use chart paper that can be easily taped or pinned to a board and quickly removed to be used in a new location. A good way to evaluate an agenda is to ask the question, "If a student were absent, could he or she read the agenda and know what happened in the classroom today?"

The dispatch activity is an essential part of the agenda. It should be a short, written, timed exercise that students start as soon as the period begins. Students should be able to complete the dispatch without teacher assistance. The dispatch is used to:

- review and reinforce concepts and ideas previously studied
- start students working immediately upon arrival in class
- preview or introduce new work
- establish a routine
- allow the teacher an opportunity to take care of attendance responsibilities

Below is a sample agenda as it would be written on the board:

AGENDA

Teacher's Name
Physics AB, Period 1
September 25, 1990

Objective:	Students will hypothesize regarding the properties which may affect the period of pendulum. Their hypotheses will be tested in an experiment.
Dispatch:	Referring to instructions on the board or handout, write a statement giving reasons why the mass of the pendulum, bob, angle of release, or length, will affect the period of a pendulum. Construct data tables to record laboratory data providing for three masses, three angles of release, and five pendulum lengths.
Classwork:	Discuss the importance of pendulums, both historically and in our lives. Discuss the written student statements and the characteristics of well-designed data tables.
Independent Work:	Perform Experiment 10 in Section III of this Course of Study.
Homework:	Read and report on Galileo and the pendulum and the Foucault pendulum.

QUESTIONS AND COMMENTARY FOR TEACHING DECISIONS

1. What is the specific objective and how will it be presented to the students?

   The specific objective tells what students will be able to do by the end of the lesson. It should be a refinement of the broader representative objective selected for the lesson from the course description in the Guidelines for Instruction or from the required course of study. The specific objective may be presented orally or in writing.

2. What is the value to students in achieving the objective?

   The teacher explains to the students the importance of achieving the objective and how it relates to past or future learning or their total development. The teacher motivates the students by providing a rationale for achieving the objective.

3. What learning activities are suitable for the students involved and for the specific objective being taught?

   The teacher selects or designs initial learning activities--such as a demonstration, film, a text selection, a lecture, class or small-group discussion, or questions followed by student answers--which fit the ability level or learning styles of the students. Similarly, the teacher develops initial learning activities which constitute the most efficient means for putting across the particular specific objectives.

4. What guided group practice will be provided for the students?

   The teacher has the class perform some of the steps leading toward mastery of the specific objective to determine if the students understand the concepts well enough to perform the tasks independently. Student responses give the teacher feedback on the students degree of understanding.

5. What independent practice or activity will be provided for the students?

   The teacher gives the students the opportunity to perform the task stated in the objective with little or no teacher assistance.

6. What are the provisions for individual differences in style of learning?

   a. Remedial or Alternative Activities: The teacher provides other kinds of learning activities for students requiring alternative opportunities to practice the task.

   b. Enrichment or Supplemental Activities: The teacher provides learning activities for students who were successful and can profit from probing the subject to a greater depth or by extending the subject to other areas.

7. How will the lesson be evaluated?

   To plan learning activities for future lessons, the teacher assesses students' mastery of the skill or skills of the present specific objective. The evaluator can be a student, a group of students, or the teacher. An objective test, a subjective test, or a performance test can be used to assess students' ability to perform the objective.

LESSON PLAN FORMAT

Subject or Course: Teacher:

Representative Objective:

Sending and Receiving Skill(s) Emphasized: Speaking___ Writing___ Reading___
Listening___ Thinking___

Thinking Level or Cognitive Level: Knowledge___ Comprehension___ Synthesis___
Analysis___ Application___ Evaluation___

1. Specific Objective and How Presented to Students:

2. Value to Students in Achieving the Objective:

3. Initial Instructional Activity to Teach Objective to Students:

4. Guided Group Practice:

5. Independent Practice or Activity:

6. Provision for Individual Differences in Ways of Learning:
   a. Remediation or Alternative Activities:
   b. Enrichment or Supplemental Activities:

7. Evaluation:
   a. Summary:
   b. Homework:

HIGHER LEVELS OF THINKING

Because questioning is the primary tool in achieving educational goals, teachers will want to be sure their questions are appropriate for the ability level of students and challenge students to higher levels of thinking.

Bloom classifies six levels of thinking.* They are:

- Knowledge (recognition or recall of previously learned material)
- Comprehension (translation or interpretation of data)
- Application (application of past learnings to a new situation)
- Analysis (emphasis on the breakdown of material into constituent parts, the detection of relationships, and the organization of parts)
- Synthesis (organization of separate elements in a new creative structure)
- Evaluation (arrival at value judgments about a material or work)

The levels of thinking are sequential. In other words, each category of thinking is different and builds on lower categories. The categories are arranged from simple to complex and from concrete to abstract.

It is important that all students have many opportunities to answer questions involving every level of thinking. Within each category of thinking there are both simple and complex questions for slow and rapid learners.

Questioning is particularly important during guided group practice in the teacher-directed lesson. Carefully constructed questions using various levels of thinking will help the teacher determine the students' comprehension of new material and assess their readiness to move on to independent practice. Individualization of instruction and remedial or alternative work can be achieved by constructing questions of varying levels of complexity.

Verbs alone do not necessarily determine the level of thinking. A given question may not represent the same task to all students. What may be an analysis question to one student may be a knowledge question to a student who has already read and received an explanation of the material. The level of a question depends on how much information the student has already received. If a student is expected to answer a "why" or "how" question by restating an answer provided in the textbook or from the teacher's lecture, the level of thinking is knowledge. If, however, the student has to figure out the answer, not simply remember it, the student is working on a higher level of thinking, such as analysis, synthesis, or evaluation.

*Benjamin S. Bloom: Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook I: Cognitive Domain, (Longman Inc., New York, 1956).

Six categories of thinking and suggested verbs for teachers are provided below. Teachers will find these helpful in constructing questions and planning lessons. For further classification of learning levels in the affective and psychomotor domains, teachers are referred to Reaching Higher Levels of Thought, Los Angeles Unified School District, Office of Secondary Instruction, Publication No. X-118, 1982.

MAJOR CATEGORIES AND SUGGESTED VERBS
FOR USE IN STATING COGNITIVE OUTCOMES

KNOWLEDGE	COMPREHENSION	APPLICATION	ANALYSIS	SYNTHESIS	EVALUATION
define	translate	interpret	distinguish	compose	judge
repeat	restate	apply	analyze	plan	appraise
record	discuss	employ	calculate	propose	evaluate
list	describe	use	experiment	design	rate
recall	recognize	demonstrate	test	formulate	revise
name	explain	dramatize	compare	arrange	score
relate	express	practice	contrast	assemble	assess
underline	identify	illustrate	criticize	collect	estimate
	locate	operate	diagram	construct	choose
	report	schedule	inspect	create	measure
	review	shop	debate	set up	select
	tell	sketch	inventory	organize	value
			question	manage	
			relate	prepare	
			solve		
			examine		
			categorize		

MAJOR THINKING SKILLS

To be successful at work, at school, and in life, students must learn two very important thinking processes. These include problem solving and decision making. These two processes are used by everyone--from students to homemakers to scientists. The steps for each are outlined below.

A. Steps in the Problem-Solving Process

1. Clarify the problem.
   Clarify the problem by asking questions, discussing ideas, making observations, estimating, determining costs and times, and so forth.
2. Hypothesize the solution(s).
   Based on what was discovered during the clarification process, "jump in" (speculate) with calculated guesses as to what one or more solutions might be. Write out each solution that can be determined. Start out with the statement, "To solve this problem (as identified) I/we can do the following...."
3. Test the hypothesis(es).
   This involves further thinking, investigation, reading, discussion, and so forth. Not all hypotheses will turn out to be reasonable, acceptable, or correct. Eliminate any that do not fit these or other established standards.
4. Draw a conclusion about the hypothesis(es).
   It is hoped the very best solution will now be clear. If it is not clear, further investigation will be required.
5. Put the solution into practice to solve the problem.
   If the best solution does not work, start the process all over again.

B. Steps in the Decision-Making Process

1. Define a goal by writing it down.
   It is important to know what is wanted; that is, the goal one is working toward. Goals may be short-term or long-term.
2. Identify the alternatives.
   This may be an easy or difficult step, but it is essential. Some individuals may feel uncomfortable with many alternatives; others like to know all the possibilities. A list of every possibility should be written. Sometimes "good" alternatives might be overlooked if the list is not written, and "poor" alternatives may seem wonderful when they are only in one's mind.
3. Identify obstacles to achieving the goal.
   Almost no goal can be reached without some "roadblocks" or deterrents. It is essential to write out as many of these obstacles as can be determined. This may require investigation, reading, and discussion.
4. Analyze the alternatives.
   Under each alternative, write down the positives and negatives of each. The more pluses and minuses that can be determined, the better the final outcome will be. It is important that individuals look at everything that will affect them if they are the only person involved; if others are part of the ultimate decision, the thoughts and feelings of the others must be considered.

5. Rank the alternatives.
   Cross off any choices that are uncomfortable, that would hurt oneself or others, that would "cost" too much, and so forth. Then, place a "1" beside the choice that appears best, a "2" by the second best, and so forth. This requires reexamining all the alternatives one last time.
6. Choose the "best" alternative.
   Unless the decision involves life or death, even if the "best" alternative is not the best after all, a second or third choice could be made. But, usually, if all the above steps have been completed, the best choice will probably be just that--the best!

Ways to Improve Student Thinking

1. Ensure that students process information.
2. Ask broad, open questions.
3. Wait before calling on students.
4. Follow up student responses by asking for: clarification, elaboration, evidence, thinking process.
5. Have a clear purpose, plan a sequence of activities to accomplish it.
6. Make students conscious of their own thinking processes.
7. Model problem solving and other thinking processes.
8. Have students ask questions of their own.

IMPROVING THE SELF-IMAGE AND SELF-WORTH OF STUDENTS

The educational program seeks to help each student develop a positive self-concept. As an important part of the instructional program, opportunities should be provided for each student to:

- Gain positive feelings about self.
- Take pride in ethnic background, culture, and heritage.
- Increase self-confidence.
- Exhibit self-direction.
- Accept responsibility for own actions.

Progress toward achieving these goals is increased when teachers frequently use the strategies described below.

1. Students are offered opportunities for success.

2. Students are informed of their strengths, weaknesses, and progress.

3. Students are encouraged to assume responsibility for their own learning.

4. Classroom environment reflects an acceptance and valuing of the work, both creative and academic, of all students.

5. Varied grouping patterns in class enhance interaction of students and increase understanding of different ethnic and cultural backgrounds.

6. Positive reinforcement is used in valuing student's choices, efforts, and accomplishments.

7. A variety of materials is used to provide for the diverse interests and strengths of students.

8. Opportunities are offered to make choices, to be self-directing, and to participate in self-checking and self-correcting activities.

9. Efforts are made to develop positive attitudes toward school and self.

10. Absenteeism is discouraged.

11. Students are helped to recognize and accept individual differences in their classmates.

GUIDELINES FOR ASSIGNMENT OF HOMEWORK*

Homework, which is a necessary part of each student's educational program, is purposeful when it provides the student with time to complete or expand upon assignments begun in class; develops good work habits and a sense of responsibility for completing tasks on time; and provides opportunities for the student to engage in creative projects, self-directed activities, and research in the area of his or her developing interests. Furthermore, purposeful homework is related to classwork and the objectives of the course, emphasizes quality rather than quantity, is consistent with the grade level and maturity of the student, and should be reflected in the subject mark.

1. Daily homework assignments are important resources for teachers in helping students learn.

2. Homework assignments should be reasonable in content, length, and resources required. Books and other materials required for assignments should be provided or easily obtainable.

3. Homework for all students should be purposeful and clear and should be based on the needs of the class. It should be modified for students with special needs. It should never be assigned as a punishment.

4. Homework may be scheduled over an extended period of time that may include weekends and vacations. If homework is assigned over an extended period, regular checks on progress should be made by the teacher.

5. Homework should be directly related to the content and objectives being taught. Students should not be given homework assignments they have not been taught how to do. Homework should be assigned to reinforce and enrich student knowledge or extend abilities. The assignment should always be stated in terms of the skill or concept being reinforced rather than in terms of the chapter, unit, or page number in a given text.

6. Homework assignments and due dates should be thoroughly explained by the teacher in advance and thoroughly understood by the student and parents. The written description of the goals and subject content provided to parents at the beginning of the course should include homework requirements and criteria.

7. When appropriately assigned and explained by the teacher, homework becomes the responsibility of the student to understand, complete, and return by the expected due date.

8. Completed homework assignments should be acknowledged and recorded by teachers in a timely manner and reviewed with students.

9. Parents should be notified when students do not complete homework assignments or show signs of significant decline in effort or achievement.

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*Adapted from the Office of the Associate Superintendent, Instruction, Bulletin No. 22 (REV.), April 30, 1990, "Homework and Makeup Assignments for School Absences in Grades K-12."

SECTION III

APPENDIX

RESOURCES

Stock Number	Author	Title	Publisher	Copyright Date	Item
332-180	Goodstein	Sci-Math, Module One	Addison-Wesley	1983	6817
332-181	Goodstein	Sci-Math, Module One, Teacher's Edition	Addison-Wesley	1983	6818
332-182	Goodstein	Sci-Math Module Two	Addison-Wesley	1983	6819
332-183	Goodstein	Sci-Math Module Two Teacher's Edition	Addison-Wesley	1983	6820
334-754	Haber-Schaim, et. al.	Introductory Physical Science, Fourth Edition	Prentice-Hall	1987	6821
334-755	Haber-Schaim, et. al.	Introductory Physical Science, Fourth Edition, Teacher's Guide & Resource Book	Prentice-Hall	1987	6822
	ISCS:	The Natural World Modules/ Level 3	Silver Burdett	1977	
341-430		Crusty Problems			6385
341-431		Crusty Problems, Teacher's Ed.			6386
341-400		In Orbit			6387
341-402		In Orbit, Teacher's Ed.			6388
385-490		What's Up?			6389
385-492		What's Up? Teacher's Ed.			6390
386-470		Winds and Weather			6391
386-472		Winds and Weather, Teacher's Ed.			6392
386-438		Resource Book			6393
386-439		Resource Book, Teacher's Ed.			6394
302-132	American Chemical Society	Chemcom	Kendall/ Hunt	1988	7452
302-133	American Chemical Society	Chemcom, Teacher's Guide	Kendall/ Hunt	1988	7453

Stock Number	Author	Title	Publisher	Copyright Date	Item
303-460	Atkinson, Heikkinen	Reactions and Reason, An Introductory Chemistry Module	Kendall/ Hunt Harper, Row	1978	7456
303-461	Atkinson, Heikkinen	Reactions and Reason, An Introductory Chemistry Module, Teacher's Guide	Harper, Row	1978	7457
322-963	Devoe	Communities of Molecules, A Physical Chemistry Module	Harper, Row	1978	7458
322-964	Devoe	Communities of Molecules, A Physical Chemistry Module, Teacher's Guide	Harper, Row	1978	7459
332-246	Gordon, Keifer	The Delicate Balance, An Energy and the Environment Chemistry Module	Harper, Row	1978	7460
332-247	Gordon, Keifer	The Delicate Balance, An Energy and the Environment Chemistry Module Teacher's Guide	Harper, Row	1978	7461
340-300	Huheey	Diversity and Periodicity, An Inorganic Chemistry Module	Harper, Row	1978	7462
340-301	Huheey, Sandoval	Diversity and Periodicity, An Inorganic Chemistry Module Teacher's Guide	Harper, Row	1978	7463
342-095	Jarvis, Mazzocchi	Form and Function, An Organic Chemistry Module	Harper, Row	1978	7464
342-096	Jarvis, Mazzocchi, Hearle	Form and Function, An Organic Chemistry Module Teacher's Guide	Harper, Row	1978	7465
350-838	Martin, Sampugna	Molecules in Living Systems, A Biochemistry Module	Harper, Row	1978	7466

Stock Number	Author	Title	Publisher	Copyright Date	Item
350-839	Martin, Sampugna, Sandoval	Molecules in Living Systems, A Biochemistry Module, Teacher's Guide	Harper, Row	1978	7467
382-625	Viola	The Heart of Matter, A Nuclear Chemistry Module	Harper, Row	1978	7468
382-626	Viola	The Heart of Matter, A Nuclear Chemistry Module, Teacher's Guide	Harper, Row	1978	7469
365-215	Price, et al	Merrill Pre Algebra, Student Edition	Merrill	1986	5340
365-216	Price, et al	Merrill Pre Algebra, TAE	Merrill	1986	5341
365-218	Price, et al	Merrill Pre Algebra, Solutions Manual	Merrill	1986	5343
365-219	Price, et al	Merrill Pre Algebra, Teacher Resource Book	Merrill	1986	5344
328-544	Foster, et al	Merrill Algebra One	Merrill	1990	5377
328-545	Foster, et al	Merrill Algebra One TAE	Merrill	1990	5378
328-547	Foster, et al	Merrill Algebra One Teacher Resource Book Package	Merrill	1990	5380
328-549	Foster, et al	Merrill Algebra One Solutions Manual	Merrill	1990	5382
309-300	Bolster, et al	Mathematics In Life	Scott Foresman	1989	5511
389-356		Mathematics In Life Answer Key	Scott Foresman	1989	5512
309-305	Bolster, et al	Mathematics In Life Teacher's Edition	Scott Foresman	1989	5515
389-362		Mathematics In Life, Teacher's Resource Book	Scott Foresman	1989	5518

Stock Number	Author	Title	Publisher	Copyright Date	Item
309-308	Bolster, et al	Consumer and Career Math	Scott Foresman	1989	5527
309-309	Bolster, et al	Consumer and Career Math Teacher's Edition	Scott Foresman	1989	5528
309-355		Consumer and Career Math Answer Key	Scott Foresman	1989	5530
389-363		Consumer and Career Math Teacher's Resource Book	Scott Foresman	1989	5534
306-589	Buzik, et al	Invitation to Mathematics 7 Problem-Solving Sourcebook	Scott Foresman	1985	5551
313-560	Butts, et al	Invitation to Mathematics 8 Problem-Solving Sourcebook	Scott Foresman	1985	5552
316-470	Charles, et al	Problem-Solving Experiences in Mathematics 7 Sourcebook	Addison Wesley	1985	5558
352-720	McKeague	Beginning Algebra: A Text/Workbook	Academic Press	1985	5642
364-820	Posamentier	Math Motivators! Investigations in Pre-algebra	Addison Wesley	1982	5654
373-370	Shapiro, et al	College Entrance Review in Mathematics Aptitude	Educators Publishing Service	1988	5675
373-371	Shapiro, et al	College Entrance Review in Mathematics - Level 1	Educators Publishing Service	1984	5676